OMB No. 0925-0001/0002 (Rev. 08/12 Approved Through 8/31/2015)

BIOGRAPHICAL SKETCH

NAME: Stephen H. Carr

POSITION TITLE: Professor of Materials Science and Engineering and Chemical and Biological Engineering, Northwestern University

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
University of Cincinnati	B.S.	06/1965	Chemical Engineering
Case Western Reserve University	M.S.	06/1967	Macromolecular Science
Case Western Reserve University	Ph.D.	01/1970	Macromolecular Science

A. Personal Statement

I n my first 25 years at Northwestern, my research focused on polymeric materials in widely varying contexts, ranging from biopolymers to electrooptically active polymers to structural polymers. There then followed 23 years as the dean of undergraduate engineering at Northwestern. These years were also productive, as we were able to make major changes with engineering learning in the first year and with establishing the intellectual processes of doing design as legitimate components of an engineering education. In the recent years I have been able to redirect my attention to the area of materials selection. The opportunity here is to shape this essential engineering activity of the materials field so that students in all technical disciplines can become motivated to learn about materials and how they perform in service.

B. Positions and Honors

1965 to 1970. Thesis research as a National Institutes of Health. Predoctoral Fellow in the Division of Macromolecular Sciences, CWRU, Eric Baer, Advisor.
1970 to 1973. Assistant Professor in the Departments of Materials Science and Engineering and Chemical Engineering, Northwestern University.
1973 to 1978. Associate Professor in the Departments of Materials Science and Engineering and Chemical Engineering, Northwestern University.
1973 to 1991. Professional Staff (Associate in Surgical Research) Evanston Hospital, Evanston, Illinois.
1984 to 1990. Director, Materials Research Center, Northwestern University
1992 to 2015. Senior Assoc. Dean for Undergraduate Engineering, Robert R. McCormick School of Engineering and Applied Science, Northwestern University.
2015 to present. Co-Director, Master of Product Design and Development Management program.
1978 to present. Professor in Departments of Materials Science and Engineering, Chemical and Biological Engineering, and Biomedical Engineering, Northwestern University Assistant Chairman, MS&E Department 1978-1982.
1972 to present. Private consultant to companies producing materials and articles for medical, industrial, consumer, automotive, and electronic markets.

C. Awards and Recognitions:

Fellow, ASM International (election in 1992).
Fellow, American Physical Society (election in 1983).
Outstanding Alumni Achievement Award, University of Cincinnati, College of Engineering, 1993.
1980 Ralph R. Teetor Award, Society of Automotive Engineers.
Educational Service Award (1975), Plastics Institute of America.

D. Contribution to Science

Has shown how physical microstructures in electronically conducting or optically active polymer solids determine their charge transport and/or second harmonic optical processes. These solids include organic metals, hyperpolarizable polymers, and/or alloys with rod-like polymers (which impart unusually high mechanical strength and stiffness).

Was the first to demonstrate and explain that flow in polymer melts is capable of modifying the miscibility between two polymers of an alloy. Flow-induced miscibility in a polymer blend is important in processing of multi-component polymer systems.

Was among the first to advance our understanding of aging in polymer solids by applying non-linear fracture mechanics and advanced models of thermally activated processes. Brittle fracture in highly ductile polymers, (*e.g.,* polyethylene alloys) and thermosetting resins are two areas in which significant progress was made.

Was the first to explain and prove quantitatively how flow in a polymer melt accelerates its crystal nucleation rate. Earlier studies by Prof. Carr's group advanced our understanding of the effects of flow on microstructure development within a freezing polymer, such as occurs during injection molding or fiber spinning.

Was able to contribute substantially to our basic understanding of piezoelectric polymers, such as are used in transducer devices, such as hydrophones and motion detectors. The work was able to distinguish between polarization caused by oriented dipoles from that caused by separated and trapped real charges.

Was among the first to demonstrate the distinctive way enzymes operate when they are **inside** a polymer solid (as opposed to the usual situation of being in an aqueous solution). Such a mode of operation applies to biodegradation, industrial fermentations, and basic physiological events, such as those associated with exercise.

Was responsible for discovering that the key constituent of human gallstones is a network polymer derived from bilirubin. This discovery explained, for the first time, why so-called pigment material in a stone cannot be dissolved. It resulted in new approaches to gallstone disease therapy and prevention.

Was first to demonstrate a comprehensive scheme for controlling toughness in densely-crosslinked polymers (*e.g.,* epoxy resins) using variations in molecular architecture and controlled phase-separation of a rubbery component.

Led the organizational processes by which faculty within the McCormick School of Engineering revised its first year experience and established a college-wide culture of design thinking.